

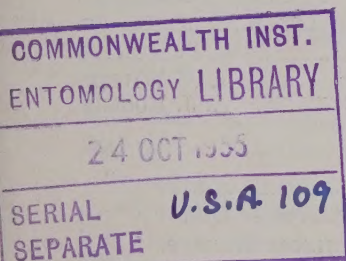
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CONCERNING THE GENUS *MICROVELIA* WESTWOOD,
WITH DESCRIPTIONS OF TWO NEW SPECIES AND
A CHECK-LIST OF THE AMERICAN FORMS
(HEMIPTERA: VELIIDAE)

CARL J. DRAKE¹ and ROLAND F. HUSSEY²

For many years the authors have collected and purchased water-striders from various countries of the Americas. During this time many specimens also have been determined for fellow workers, universities, museums, and other institutions. Several collections are rich in species and in numbers of individual specimens, yet we believe that many undescribed species still remain to be discovered. This is evidenced by the systematic papers, with characterizations of new species, which appear year after year in technical journals.

In order to bring up to date the inventory of scientific names, classification, distribution, and other data, the authors are now preparing a catalog of the water-striders of the western hemisphere. As the data are being assembled, it seems desirable to publish notes from time to time on nomenclature, synonymy, and distribution, together with descriptions of some new species.

The present paper concerns the genus *Microvelia*, one of the largest genera of the Veliidae. It is represented in all the continents and occurs on many of the oceanic islands. Its species are most numerous, and individuals most abundant, in tropical and subtropical regions. A single species, *Microvelia buenoi* Drake, has thus far been found in Alaska, where many specimens were collected by Dr. R. I. Sailer in the summer of 1953.

In 1909, Kirkaldy and Torre-Bueno catalogued only 20 species of *Microvelia* from the Americas, including Hawaii. Fifteen years later, Torre-Bueno (1924) listed and gave a preliminary key to 28 American species. Since then many new species have been described, several have been reduced to synonyms, and a number of other nomenclatorial changes have been made. The present paper includes a list of 71 species and subspecies of *Microvelia* now known from the western hemisphere. Except for a single one, found thus far only in Hawaii, all of these seem strictly indigenous in the Americas. Two species are here de-

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scribed as new to science, and new synonymy is indicated for some previously known forms. The taxonomic and ecological advances made since 1909 reflect the ever-growing interest and the rapid progress being made in studying the water-strider fauna of the New World.

THE GENERIC TYPE OF MICROVELIA

The conclusion seems to us inescapable that *Microvelia pulchella* Westwood 1834, must be accepted as the generic type of *Microvelia*, under the *Règles* as they have stood since 1948. We know from Burmeister's comment (1835, p. 213, footnote) that Plate VI, where this species was figured and where the name *Microvelia Pulchella* appeared, was distributed with Part II of Volume III of the *Annales de la Société Entomologique de France*, while the text of Westwood's article was in a later part of that volume. This "indication" of the species *pulchella* was sufficient, under the *Règles*, to validate the generic name *Microvelia*, which thus dates from the publication of Plate VI rather than from the publication date of the article itself. No other *Microvelia* was illustrated or named on this plate. *Microvelia* was therefore a monobasic genus at the time it was founded; and *pulchella*, its only included species, is the type by monotypy. This, however, is clearly at variance with Westwood's own concept of the genus at the time he founded it.

In the text of his article, after describing the new *Velia* (*Microvelia*) *Pulchella* [capitalization as in the original] and comparing it with *Velia Pygmaea* Dufour, Westwood wrote: "The discovery of a second species of *Velia* which agrees in its general structure with *Velia Pygmaea* makes it necessary to establish a section or subgenus for their reception." He then contrasted some characters of *Velia* and of *Microvelia* in parallel columns (p. 648). In later pages of the article the new category was referred to on three occasions simply as *Microvelia*, once as *Velia Microvelia* [sic].

Throughout this paper the combination *Velia Pygmaea* was the only one used for Dufour's species, though Kirkaldy (1899) stated otherwise. As already noted, Westwood's new Antillean species was designated *Microvelia Pulchella* on the plate, but in the text its name appeared both as *Velia* (*Microvelia*) *Pulchella* and as *Velia Pulchella*. However, Westwood's statement quoted above shows clearly that he intended *Microvelia* to include both *pulchella* and *pygmaea*.

Six years later Westwood (1840a), treating *Microvelia* as a distinct genus, cited *M. pygmaea* as its "typical species." No further reference to a generic type appeared in the literature until 1901, when Kirkaldy accepted *pygmaea* as the type; and subsequent writers have very generally followed this practice. Notable exceptions have been Distant (1903), Horváth (1916), and Poisson (1941), all of whom cited *pulchella* as type but gave no reasons for doing so.

If it were not for the circumstances set forth above, we too might have followed the majority action, and might have cited *pygmaea* as the type species of *Microvelia*. Under Opinion 71 of the International Commission on Zoological Nomenclature, published in January 1922, all of Westwood's 1840 citations of "typical species" are to be accepted as valid type designations, provided (1) such species were available as types of their respective genera, and (2) there had been no earlier valid type designation for the genus under consideration. If Westwood's plate had been published simultaneously with the text of his 1834 article, both *pulchella* and *pygmaea* would have been available and his naming of *pygmaea* would have been valid. But there would still remain some doubt as to whether Westwood had correctly identified *Microvelia pygmaea* Dufour.

Hydroessa Burmeister, 1835, haplotype *H. reticulata* Burmeister, 1835, is technically a subjective synonym of *Microvelia* Westwood, 1834, since its type species is undoubtedly congeneric with, but specifically distinct from, both *pulchella* Westwood and *pygmaea* (Dufour). In the footnote referred to above, Burmeister remarked that the name *Hydroessa* was already in manuscript when he received the illustrations (but not the text) of Westwood's article, and he did not scruple to prefer that name to *Microvelia* since the latter violated a Linnean precept against making new generic names by "dressing up" older ones that were already in use.

Although Burmeister stated that *reticulata* was the more common of the two *Hydroessa* species known to him as occurring at Berlin, he failed to identify the other one as *pygmaea*. Instead, he placed under *reticulata*, as synonyms, both *pygmaea* and *pulchella*, the latter known to him only from Westwood's figure where there was no indication given that this was an extra-European species.

Westwood (1840) reaffirmed the specific distinctness of *pulchella*. Without mentioning *reticulata* at all, he resurrected

pygmaea as the earliest name applicable to the European species, noted that Curtis had figured it as *Hydroessa pygmaea* from specimens taken in Ireland, and stated that he himself had collected Dufour's species at two places in England some fifteen years earlier. It seems to us most likely indeed that when Westwood (1840a) cited *pygmaea* as "typical species" of *Microvelia* in his "Synopsis of the Genera of British Insects," his action was based upon this British material.

Blanchard (1840) also resurrected the name *pygmaea* Dufour, placing *reticulata* Burmeister as synonymous with it. This synonymy was followed by all later authors until Horváth (1916) properly identified the two German species referred to by Burmeister in 1835, treating them as *pygmaea* Dufour and *reticulata* Burmeister (= *schneideri* Scholtz, 1846). Horváth's disposition of these species has been accepted by most European workers, though not by Stichel (1934). *Microvelia reticulata*, *M. pygmaea*, and also *M. umbricola* Wróblewski, 1938, all are now known to occur in England, but *M. reticulata* is reported as being by far the most abundant of the three. Thus there is a strong possibility that the species called *pygmaea* by Westwood in 1840 was in reality *reticulata* Burmeister, or perhaps even *umbricola* Wróblewski. Examination of Westwood's specimens will be necessary in order to resolve the uncertainty which thus surrounds the identity of his "typical species."

The list of bibliographic citations for the genus *Microvelia* which follows is by no means complete. It includes, however, the references that are most important for generic synonymy, for citations of generic types, and for summations concerning the American and other faunas, as well as the references which have been cited above.

Genus MICROVELIA Westwood, 1834

Type *Microvelia pulchella* Westwood, 1834

- Microvelia* 1834 Westwood, Ann. Soc. Ent. France 3(2), Pl. 6, fig. 5. [Monobasic; *M. pulchella* only included species.]
- Velia* (*Microvelia*) 1834 Westwood, Ann. Soc. Ent. France 3(3): 648. [As "section or subgenus" of *Velia*. Included: *Velia* (*Microvelia*) *pulchella*, n. sp., and *Velia pygmaea* Dufour, 1833.]
- Hydroessa* 1835 Burmeister, Handb. Ent. 2(1): 213; haplotype *reticulata*, n. sp.; both *pygmaea* Dufour and *pulchella* Westwood wrongly synonymized with this. [Unnecessary new name for *Microvelia*, rejected as improperly formed. Two other unnamed species, one German and one Brazilian, mentioned as belonging here.]
- Microvelia* 1835 Brullé, Hist. Nat. Ins. 9: 295. [Synonymy of *pygmaea* and *pulchella* doubted.]

Microvelia

- 1840 Blanchard, Hist. Nat. Ins. 3: 96. [On p. 97, *reticulata* and *pulchella* placed as synonyms of *pygmaea*.]
- 1840 Westwood, Introd. Mod. Class. Ins. 2: 470. [*M. pulchella* and *M. pygmaea* distinct species; the latter reported from England.]
- 1840a Westwood, Synopsis Genera Brit. Ins., p. 119 (in Introd. Mod. Class. Ins., vol. 2, separately paged). [*M. pygmaea* named "typical species" of *Microvelia*.]
- Hydroessa* 1842 Herrich-Schaeffer, Wanz. Ins. 6: 37. [*H. pulchella* figured on Tab. 193, fig. 595.]
- Microvelia* 1843 Amyot and Serville, Hist. Nat. Hémip. 421. [*M. pulchella* redescribed after Westwood; no other species mentioned.]
- Hydroessa* 1850 Herrich-Schaeffer, Wanz. Ins. 9: 78.
- Hydroessa* 1860 Fieber, Eur. Hem. 33 [in keys], and 1861, op. c. 104.
- Hydroessa* 1865 Stål, Hem. Afr. 3: 167. [In generic keys only.]
- Microvelia* 1865 Douglas and Scott, Brit. Hem. Het. 574.
- 1892 Saunders, Hem. Het. Brit. Isl. 150.
- Velimorpha* 1895 Carlini, Ann. Mus. Civ. Genova 35: 120; haplotype *V. maculata*, n. sp. [Synonymized with *Microvelia* by Champion, 1898.]
- Microvelia* 1898 Champion, Biol. Centr. Amer., Hem. Het. 2: 126-130. [Review of Central American species, with key to 8 species, all new; comments on some Antillean forms.]
- Hydroessa* 1899 Kirkaldy, Entomol. 32: 113. [*Microvelia* as genus dated from Amyot and Serville, 1843, since Westwood, 1834, regarded it merely as subgenus.]
- Microvelia* 1900 Kirkaldy, Entomol. 33: 27-28. [*Microvelia* recognized as valid generic name from 1834, with priority over *Hydroessa*.]
- 1901 Kirkaldy, Entomol. 34: 218. [*pygmaea* cited as generotype.]
- 1903 Distant, Faun. Brit. Ind., Rhynch. 2: 147. [*pulchella* cited as generotype.]
- 1906 Kirkaldy, Trans. Amer. Ent. Soc. 32(2): 154. [Summary of generic and generotypic synonymies; *pygmaea* cited as type, with *reticulata* as synonym.]
- 1909 Kirkaldy and Torre-Bueno, Proc. Ent. Soc. Wash., 1908, 10(3-4): 207-208. [Catalogue of 20 American species.]
- Kirkaldya* 1910 Torre-Bueno, Canad. Ent. 42(5): 186; as subgenus, type *Microvelia americana* (Uhler). [Suppressed as subgenus by Parshley, 1921: 89.]
- Picaulitia* 1913 Distant, Trans. Linn. Soc. London 16: 161; type *Picaulitia pronotalis* n. sp., from Seychelles. [Synonymized with *Microvelia* by China and Usinger, 1949.]
- Microvelia* 1916 Horváth, Ann. Mus. Nat. Hungar. 14: 68-71. [Distinctions between *M. pygmaea* Dufour (= *nilicola* Costa, 1875) and *M. reticulata* Burmeister (= *schneideri* Scholtz, 1846). *M. pulchella* cited as type "without the slightest doubt."]
- 1916 Torre-Bueno, Bull. Brooklyn Ent. Soc. 11(3): 56-57. [Key to species of the Atlantic coastal states.]
- 1917 Van Duzee, Univ. Calif. Publ. Ent. 2: 432-434. [Bibliographic catalogue of North American species; generic types and their synonymies cited.]
- 1921 Parshley, Bull. Brooklyn Ent. Soc. 16(3-4): 87-93. [Key to apterous forms of eastern North America; morphology of their pronota.]
- 1921 Pennington, Lista Hem. Het. Rep. Argentina, 31. [*M. mendozana* the only species listed from Argentina.]
- 1923 Torre-Bueno, Bull. Brooklyn Ent. Soc. 18(4): 138-143. [Review of generic and specific characters in *Microvelia*.]

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- 1924 Torre-Bueno, Bull. Brooklyn Ent. Soc. 19(5): 187-194. [Preliminary key to 28 American species, based largely on descriptions and figures.]
- 1926 Blatchley, Heter. e. N. America, 988. [Descriptions of eight species of eastern North America, with key.]
- 1933 Lundblad, Arch. Hydrobiol., Suppl. 12: 307-364. [Profusely illustrated review of 17 Indian, Oriental, Australian, and Indonesian species, with key to males pp. 369-370.]
- 1941 Poisson, Rev. franç. Ent. 8(4): 161-188, figs. 1-33. [Review of 14 African species and subspecies, with key. *M. pulchella* cited as type.]
- 1943 China, Generic Names Brit. Ins., Part 8: 275. [*M. pygmaea* cited as type; list of three British species.]
- 1949 China and Usinger, Ann. Mag. Nat. Hist. (12)2: 352. [In generic key to Veliidae, subfamily Microveliinae (new subfamily p. 351).]

SUBGENERA OF MICROVELIA

Since 1950 several subgenera have been erected within *Microvelia* by Hoberlandt and by Poisson for certain African and Madagascan species, and *Xiphoveloidea* Hoberlandt, 1951, has been reduced by Poisson (1952) from generic to subgeneric status. Actual specimens of the type species of these groups have not been available to us for study, but it seems from the descriptions and the figures that none of these subgenera is represented in the American fauna. Indeed, four of them contain thus far a single species each, and three are known only from Madagascar, an island noted for the large number of strictly endemic forms which occur there. These subgenera are as follows:

- Anchorinella 1952 Poisson, Mém. Inst. Sci. Madagascar (E) 1(1): 45. [As subgenus of *Microvelia*; monobasic, haplotype *M. (A.) pauliani* n. sp., from Madagascar.]
- Annulovelvia 1952 Poisson, op. cit., 48. [As subgenus of *Microvelia*; monobasic, orthotype *M. (A.) itremoi* n. sp., from Madagascar.]
- Perivelia 1952 Poisson, op. cit., 45. [As subgenus of *Microvelia*; monobasic; orthotype *Microvelia betioky* Poisson, 1951, from Madagascar.]
- Pseudovelvia 1951³ Hoberlandt, Publ. Cultur. Comp. Diamantes Angola, Lisbon, Sep. No. 10: 33-36. [As subgenus of *Microvelia*; orthotype *Microvelia major* Poisson, 1926; also included *Microvelia jeanneli* Poisson, 1941, and *M. (P.) lundaensis* n. sp. and *M. (P.) crinita* n. sp., both from Angola. If *M. major* and *M. jeanneli* are properly placed in *Xiphoveloidea* where Poisson (1952) has relocated them, then *Pseudovelvia* automatically becomes a synonym of *Xiphoveloidea*, and a new subgeneric designation may be necessary for the other two species originally included in *Pseudovelvia*.]
- Trichovelvia 1951 Hoberlandt, op. cit., 39-41. [As subgenus of *Microvelia*; monobasic; orthotype *M. (T.) machadoi* n. sp., from Angola.]

³ This is the date cited by the Zoological Record, which refers to the separates dated 1950 as "preprints." Issuance of such preprints is not considered to constitute publication. We have seen only the 1950 separates.

Xiphoveloidea 1951 Hoberlandt, op. cit., 17-25. [As genus. Included: *X. chinai* n. sp. (designated as type) and *X. pulchella* n. sp., both from Angola. If *Xiphoveloidea* is to be regarded as a subgenus of *Microvelia*, then *M. (X.) pulchella* Hoberlandt must be renamed.]

1952 Poisson, Mém. Inst. Sci. Madagascar (E) 1(1): 48. [As subgenus of *Microvelia*, without comment on change of status; *Microvelia major* Poisson, 1926, and several subspecies, also *M. jeanneli* Poisson, 1941, transferred to this subgenus; *M. (X.) mahajambae* n. sp., described from Madagascar.]

We do not wish to discuss these subgenera extensively, since we have not been able to study specimens of their type species. However, it should be noted that the species assigned to some of them present characters conflicting with the definition of *Microvelia* given by China and Usinger (1949) in their memoir on the classification of the Veliidae. Among these are the long first antennal segment of *Xiphoveloidea* and *Trichovelia*, and the modified tarsal claws of the former. Thus our concept of the genus *Microvelia* must be considerably revised if these forms are to be retained in their present status.

Since the appearance of the paper on veliid classification by China and Usinger (1949), several genera allied to *Microvelia* have been described. Two of these, *Menuthiasia* Poisson, 1952, and *Microveloidella* Poisson, 1952, are endemic in Madagascar, as far as is known at present. A third one, *Xiphoveloidea* Hoberlandt, is listed above at the subgeneric level, on Poisson's authority, and will be further discussed briefly below. A fourth genus, *Husseyella* Herring, 1955, is American. It includes the two species, *turmalis* and *diffidens*, that were described in *Microvelia* by Drake and Harris (1933) and were transferred by them in 1936 to *Xiphovelia* Lundblad, 1933, a genus whose type species occurs in Sumatra.

A major diagnostic character of *Xiphoveloidea* would seem to be the ensiform modification of some or all of the tarsal claws so that they become, or are enclosed in, broad, flat, thin structures preserving a claw-like outline to a greater or lesser degree. Similar modifications of the tarsal claws are found in the genera *Veloidea* Gould (subfamily Veliinae), *Xiphovelia* Lundblad (Microveliinae), and *Husseyella* Herring (Microveliinae). Whenever this is found, there is also at least one other structure (two in *Veloidea* and *Husseyella*) of quite similar size and shape arising between the bases of the modified claws. Whether such modifications of the claws are in themselves adequate for generic, or only for subgeneric, segregation of the species that possess them is a matter of opinion. In *Xiphovelia*, and in *Husseyella*, there are other characters which, together with the structure

of the claws, definitely distinguish these forms from *Microvelia* at the generic level. *Xiphoveloidea* seems, from description and figures, to be less obviously distinct.

The seventy American species of *Microvelia* fall into a number of groups, some of which may perhaps be suitable for segregation as subgenera. Thus far, *Kirkaldya* Torre-Bueno, 1910, is the only such subdivision proposed for American forms, and this was suppressed when the characters on which it was based were shown to be wholly erroneous (Parshley, 1921; Lundblad, 1933).

The conformation of the male genital segments and the form of the parameres offer excellent criteria for specific distinctions in *Microvelia*. These characters have been illustrated for many of the Old World species by Lundblad, Hoberlandt, and Poisson, following the example of Miss Cheesman (1926) who, when describing *Microvelia prompta* from Tahiti, gave a figure showing not only the genital segments and the parameres, but also the sclerotized parts of the aedeagus. Among the Old World forms, some species have both parameres rudimentary; some have one paramere minute and the other one well developed; and still others have both parameres well developed and symmetrical. That the male genital characters might be utilized for segregation of subgeneric groups was suggested by Lundblad (1933), and some of the subgenera (and genera as well) subsequently erected have been based in part on genital characters.

Unfortunately, these characters have been largely neglected by previous authors (ourselves included) in describing American species of *Microvelia*. Indeed, figures of the male genital segments have been published for only two species, *M. mimula* B. White and *M. quieta* Drake and Carvalho, 1954, with the description of the latter species.

Pending further study of the American species, we feel it would be premature to attempt any subgeneric classification of them. This phase of the work will be left for subsequent investigation.

Microvelia pulchella Westwood

- 1834 *Microvelia Pulchella* Westwood, Ann. Soc. Ent. France 3(2): Pl. 6, fig. 5, a-h.
1834 *Velia (Microvelia) Pulchella*, Westwood, Ann. Soc. Ent. France 3(3): 647.
1842 *Hydroessa pulchella*, Herrich-Schaeffer, Wanz. Ins. 6: 37, Tab. 193, fig. 595.
1843 *Microvelia pulchella*, Amyot and Serville, Hist. Nat. Hémipt. 422.
1850 *Hydroessa pulchella*, Herrich-Schaeffer, Wanz. Ins. 9: 78.

- 1857 *Microvelia pulchella*, Guérin, in Sagra's Hist. Cuba 7(2): 174.
1873 *Microvelia pulchella*, Walker, Cat. Heter. Brit. Mus. 8: 160.
1896 *Microvelia pulchella*, Lethierry and Severin, Cat. Gén. Hém. 3: 56.
1907 *Microvelia pulchella*, Van Duzee, Bull. Buffalo Soc. Nat. Sci. 8(5): 23.
1909 *Microvelia pulchella*, Kirkaldy and Torre-Bueno, Proc. Ent. Soc. Wash. 1908, 10(3-4): 208.
1923 *Microvelia ?pulchella*, Torre-Bueno, Univ. Iowa Stud. Nat. Hist. 10(3): 36.
1924 *Microvelia pulchella*, Wolcott, Jour. Dept. Agr. Puerto Rico 1923, 7(1): 244.
1939 *Microvelia pulchella*, Barber, N. Y. Acad. Sci., Sci. Surv. Puerto Rico Virg. Isl. 14(3): 410-411.
1950 *Microvelia pulchella*, Wolcott, Jour. Dept. Agr. Puerto Rico 1948, 32(1): 220.
1952 *Microvelia puchella* [sic], Drake and Capriles, Gt. Basin Nat. 12(1-4): 48.
1954 *Microvelia pulchella*, Drake and Capriles, Proc. Biol. Soc. Wash. 67: 220.

Hemipterists are well agreed upon the identity of typical *Microvelia pulchella*, and the authors are in accord with this consensus of opinion. Westwood's types, in the Hope collection at Oxford, have not been examined.

This species occurs throughout the neotropical region, except perhaps in Chile, and it is found very uncommonly in its typical form in the southernmost states of the United States. We have studied several hundred specimens, both alate and apterous, from Cuba, Puerto Rico, St. Vincent, Grenada, Trinidad, Mexico, Central America, Colombia, Venezuela, British Guiana, Brasil, Perú, Bolivia, Paraguay, and Argentina. In addition, a few typical examples of *M. pulchella* have been seen from Florida, Mississippi, Texas, and Arizona. These agree in size, color, and structural details with our specimens from Cuba, Grenada, and other neotropical localities.

Guérin (1857) seems to have been the first to note variation in *M. pulchella*, for, after transcribing Westwood's original description, he added: "The insect which served for Mr. Westwood's work came from the island of St. Vincent. According to the description and the figure which he gives, and which was copied by Herrich-Schaeffer, one might be inclined to consider the Cuban individuals as varieties with the white spots of the hemelytra smaller and somewhat obscured."

Microvelia pulchella exhibits greater variability than any other American species of the genus, and embraces several forms that have been described under other specific names. Some of these are indistinguishable from one another; others intergrade with them; and none of them can be distinguished from *M. pulchella*

at the species level. It is our opinion that these constitute a single, highly variable subspecies of *M. pulchella*. It is possible that the name *capitata* Guérin, 1857, will prove to be the one that should be used for this subspecies. However, for reasons set forth below, we prefer to regard *Microvelia capitata* Guérin as a *species inquirenda* at this time, and consequently employ *incerta* (Kirby, 1890) as the subspecies designation, this being the earliest name that is surely applicable.

***Microvelia pulchella* subsp. *incerta* (Kirby) (NEW STATUS)**

- 1890 *Rhagovelia incerta* W. F. Kirby, Jour. Linn. Soc. Lond., Zool. 20: 548.
 1894 *Microvelia robusta* Uhler, Proc. Zool. Soc. London, p. 219.
 1894 *Microvelia marginata* [nec Uhler, 1893], Uhler, 1894, op. cit. 219.
 [In part; U. S. records.]
 1896 *Microvelia robusta*, Lethierry and Severin, Cat. Gén. Hém. 3: 56.
 1896 *Rhagovelia incerta*, Lethierry and Severin, op. cit., 3: 258.
 1899 *Microvelia incerta*, Kirkaldy, Rev. d'Ent. 18: 95.
 1905 *Microvelia pulchella* [nec Westwood], Torre-Bueno, Jour. N. Y. Ent. Soc. 13: 42.
 1909 *Microvelia incerta*, Kirkaldy and Torre-Bueno, Proc. Ent. Soc. Wash. 1908, 10 (3-4): 207.
 1909 *Microvelia marginata* [in part], Kirkaldy and Torre-Bueno, op. cit., 207.
 1909 *Microvelia robusta*, Kirkaldy and Torre-Bueno, op. cit., 208.
 1910 *Microvelia pulchella*, Smith, Ins. N. J., 3d ed., p. 141.
 1910 *Microvelia marginata*, Smith, op. cit., 150.
 1910 *Microvelia borealis* [nomen nudum], Torre-Bueno, in Smith, op. cit., 150.
 1910 *Microvelia marginata*, Banks, Cat. nearc. Hem.-Het., p. 27.
 1910 *Microvelia pulchella*, Banks, op. cit., 27.
 1914 *Microvelia marginata*, Barber, Bull. Amer. Mus. Nat. Hist. 33(31): 500.
 1916 *Microvelia borealis* Torre-Bueno, Bull. Brooklyn Ent. Soc. 11(3): 59. [NEW SYNONYMY.]
 1917 *Microvelia marginata* [in part], Van Duzee, Univ. Calif. Publ. Ent. 2: 433.
 1917 *Microvelia borealis*, Van Duzee, op. cit., 433.
 1917 *Microvelia robusta*, Van Duzee, op. cit., 434.
 1917 *Microvelia borealis*, Torre-Bueno, Ent. News 28(8): 354.
 1919 *Microvelia borealis* [in part], Hussey, Occas. Pap. Mus. Zool. Univ. Mich. No. 75: 13.
 1920 *Microvelia borealis* [in part], Hungerford, Kansas Univ. Sci. Bull. 1919, 11: 123 and 137 [excl. Pl. XII].
 1920 *Microvelia robusta*, Hungerford, op. cit., 126.
 1920 *Microvelia marginata* [excl. synonym and description], Hungerford, op. cit., 127.
 1925 *Microvelia borealis*, W. E. Hoffmann, Bull. Brooklyn Ent. Soc. 20(3): 93.
 1926 *Microvelia borealis*, Blatchley, Het. east. N. Amer., 989 [excl. fig. 198].
 1928 *Microvelia borealis*, Blatchley, Jour. N. Y. Ent. Soc. 36(1): 21.

- 1939 *Microvelia robusta*, Barber, N. Y. Acad. Sci., Sci. Surv. Pto. Rico Virg. Isl. 14(3): 411.
- 1953 *Microvelia robusta*, Drake and Plaumann, Dusenica 4(5-6): 415 [with *borealis* as variety].
- 1954 *Microvelia incerta*, Drake and Capriles, Proc. Biol. Soc. Wash. 67: 220 [with *robusta* as new synonym; "*robusta*" thought probably a subspecies of *pulchella*].

The types of *Microvelia incerta* (Kirby), from Fernando Noronha, and of *M. robusta* Uhler, from Grenada, are in the British Museum. These have been examined and found to be indistinguishable from one another. After studying many hundred specimens of the North American form long known as *Microvelia borealis* Torre-Bueno, the authors can find no characters to distinguish it from *M. incerta*. As stated above, all of these may eventually prove to be inseparable from *M. capitata* Guérin.

Except for its distinctly smaller average size, *M. p. incerta* does not seem to differ from typical *M. pulchella* in any essential way, and cannot be regarded as specifically distinct from it. Although *M. incerta* is treated here as a subspecies of *M. pulchella*, this is not done in the sense that the two represent geographically isolated and distinguishable forms. *M. p. incerta* ranges northward in the nearctic region far beyond the limits of typical *pulchella*, yet in the neotropical region the distribution of the two forms is the same. Indeed, specimens from a given locality, or even from a single school or swarm, sometimes show perfect intergradation between the smaller *incerta* and the larger *pulchella*, and this is true for males and females alike and for winged and wingless individuals. In general, specimens from northern localities are a little smaller than those from tropical or subtropical places.

Like typical *pulchella*, this form is quite variable in color and hemelytral markings, even among individuals taken at the same time and place. The males show great variation in the curvature of the hind tibiae: some specimens have these bowed through an angle of nearly 45°, others scarcely half as much.

Besides having been described under several synonymic names, *M. p. incerta* was long confused with typical *M. pulchella* by North American authors. It seems also to have been misidentified as *M. marginata* Uhler, 1893, by Uhler himself (1894), as regards his North American records—which were accepted by subsequent cataloguers (Kirkaldy and Torre-Bueno, 1909; Banks, 1910; Van Duzee, 1917).

Further confusion surrounding the *pulchella-incerta* complex arises from the fact that *Microvelia buenoi* Drake and *M. hinei* Drake were not distinguished from *M. "borealis"* until 1920. Thus the true identity of specimens reported before that date as either *M. pulchella*, *M. borealis*, or *M. marginata* can be determined only by inspection of the specimens concerned. Re-examination of the material from Douglas Lake, Michigan, identified by Torre-Bueno and reported as *M. borealis* by Hussey (1919), has shown that it included not only that form, but *M. buenoi* and *M. hinei* as well. Figure 198 in Blatchley's "Heteroptera" (1926), reproduced from Hungerford (1920) and captioned *Microvelia borealis*, actually represents *M. hinei*, as later stated by Blatchley himself (1928). It seems doubtful that any further confusion of these species is to be found in the literature since 1926, and for this reason no other bibliographic citations to *M. borealis* after that date are given above.

Torre-Bueno (1917) reported that *M. borealis* has only four nymphal instars instead of the five reported for other species of *Microvelia*. This was confirmed by W. E. Hoffmann (1925), who found that *Microvelia buenoi* Drake also has four nymphal instars. Both these workers obtained their material of *M. borealis* in the northern United States. It would be interesting to learn whether this condition holds true throughout the range of *M. p. incerta*, and whether it is true also for *M. p. pulchella*.

Microvelia marginata Uhler

1893 *Microvelia marginata* Uhler, Proc. Zool. Soc. London, p. 719.

1936 *Microvelia pudoris* Drake and Harris, Proc. Biol. Soc. Wash. 49: 105.

This is a distinct species, quite easily separated from the *pulchella* complex by the coloration, the very short pre-ocular part of the head, and the distinctly shorter legs as compared with the body length. We have seen only a single specimen of the true *marginata* collected in the United States. This individual, now in the U. S. National Museum, was taken at Key West, Florida, April 6, 1905, by Frederick Knab.

Microvelia capitata Guérin

1857 *Microvelia capitata* Guérin, in Sagra's Hist. Cuba 7(2): 174.

This species has long been an enigma to students of the genus *Microvelia*. Guérin's description read as follows: "Fuscous; head fulvous; neck [collum], spots on thorax, sides of abdomen, and legs fulvous; hemelytra white-spotted. Length 2, width 3/9

millim. This lovely species is very close to the preceding one [*pulchella*], but differs by its smaller size and by the coloration of the body. As for the hemelytra, they present the same whitish spots. We have received a single individual from the island of Cuba, caught by Messrs. Poey and Gundlach."

If the dimensions given by Guérin are correct, his *capitata* is an extremely slender species with the body of the alate form six times as long as wide. These body proportions do not occur in any alate forms of the *pulchella* complex. In a small sample (15 specimens) of alate *pulchella* and *incerta* from six neotropical localities, the average ratio of length to width was found to be 2.56, with standard deviation 0.166; in an equal number of alate "*borealis*" from Florida, New York, and Michigan, this ratio was 2.38, with standard deviation 0.133.

It is possible that the width stated by Guérin for *capitata* was a typographical error and that 3/4 millimeter was intended instead of 3/9 millimeter. This would bring the width of *capitata* in line with our sample of alate "*borealis*", whose pronotal width averaged 0.73 mm., or in line with the narrowest of the fifteen neotropical specimens measured, where the pronotal width was 0.77 mm.

The description, to say the least, is inadequate in other ways as well, and the identity of *Microvelia capitata* can only be established by examination of Guérin's type if it is still extant. It has not been found in the Paris Museum; nor, according to information kindly furnished us by Dr. Max Beier, is it in the Vienna Museum where certain of the Guérin types were deposited.

The name *capitata* has been used by several authors for species known to us under other names. Torre-Bueno, in several papers prior to 1916, employed it for the species generally known since that date as *M. albonotata* Champion, and Barber, in 1939, again used *capitata* for that species in his account of the Hemiptera of Puerto Rico; but Drake and Capriles (1954) have dissented from this view. All the specimens we have seen that Uhler (1894) reported from Grenada as *M. capitata* Guérin are in reality *M. mimula* F. B. White.

Microvelia albonotata Champion

1898 *Microvelia albonotata* Champion, Biol. C. Amer., Hem. Het. 2: 129, Pl. 8, fig. 17. [Type wrongly stated as male.]

So far as we are aware, no American species of *Microvelia* has hitherto been reported as having cavernicolous habits. It is interesting to record, therefore, the finding of this species in

great numbers on the pools in certain bat caves in Alachua and Gilchrist Counties, Florida. This discovery was made in the spring of 1954 by Messrs. Robert Cumming and Dale Rice, graduate students at the University of Florida, who reported finding the *Microvelia* abundant even on pools that were in total darkness. This species also occurs in Florida on woodland pools and in the cypress swamps.

A specimen collected at light on the E. S. George Reserve near Pinckney, Livingston County, Michigan, July 18, 1952 (R. F. Hussey) establishes the first record of *M. albonotata* from Michigan.

***Microvelia rufescens* Champion**

- 1898 *Microvelia rufescens* Champion, Biol. Centr.-Amer., Hem.-Het., 2: 130, Pl. 8, fig. 18.
 1937 *Microvelia hidalgoi* McKinstry, Jour. Kansas Ent. Soc. 10 (2): 40
 (NEW SYNONYMY).

Upon comparing the types of *M. rufescens* in the British Museum with paratypes of *M. hidalgoi* loaned from the University of Kansas collections, we find that the latter must be placed in synonymy.

***Microvelia guatemalensis* McKinstry**

- 1937 *Microvelia guatemalensis* McKinstry, Jour. Kansas Ent. Soc. 10(2): 38.

Comparison of type materials shows that this species and *M. torquata* Champion are very similar, but we are not prepared to say that they are identical with one another.

***Microvelia vagans* F. B. White**

- 1878 *Microvelia vagans* F. B. White, Ann. Mag. Nat. Hist. (5)1: 374.
 1925 *Microvelia pacifica* [nec Kirkaldy], W. E. Hoffmann, Bull. Brooklyn Ent. Soc. 20(3): 132.
 1937 *Microvelia williamsi* [nomen nudum] McKinstry, Jour. Kansas Ent. Soc. 10(2): 41.
 1948 *Microvelia vagans*, Zimmerman, Ins. Hawaii 3: 228, fig. 104.

This is the only species of *Microvelia* listed by Zimmerman as occurring in the Hawaiian Islands, and the only one we have seen from there. We have no doubt that Hoffmann's report of *M. pacifica* (a Fijian species) being found abundantly in Oahu should actually be referred to *M. vagans*. We are indebted to Dr. H. B. Hungerford for the information that the "*Microvelia williamsi* n. sp." mentioned but not described by McKinstry is identical with *M. vagans* White.

Though Zimmerman referred to it as an "immigrant (?)" in Hawaii, and though Kirkaldy and Torre-Bueno (1909) said

it was undoubtedly introduced there from America, we know of no specimens of *Microvelia vagans* taken in North, Central, or South America. It appears to be strictly endemic in the Hawaiian Islands.

***Microvelia chilena*, n. sp.**

APTEROUS MALE. Small, oblong, reddish brown (almost orange) with abdominal tergites 2, 3, 4, and most of 5 and 6, blackish; abdomen beneath pale testaceous, venter slightly embrowned; sides of abdomen broadly striped with blackish, bluish-pruinose; dorsal surface sparsely clothed with pale (and some dark) pubescent hairs. Head broad, convex above, with indistinct median furrow, sparsely white pubescent and with whitish pruinosity near eyes; width across eyes 0.42 mm. Rostrum testaceous, apical segment black-fuscous, slightly surpassing base of prosternum. Antennae moderately long, slender, brownish fuscous, basal segment mostly testaceous; shortly pilose; relative lengths of segments I-IV, 17:12:18:25 (80 units = 1 mm.). Legs moderately slender, brownish above, pale testaceous below; femora not much enlarged, hind femora unarmed and scarcely as thick as front pair; tarsal segments I and II subequal in length (13:12) on both middle and hind legs.

Pronotum moderately produced behind, concealing about half of mesonotum, wide and subtruncate (feebly concave) behind, much wider than its median length (40:18), divided into two lobes by a rather deep transverse furrow on each side of median line which contains deep pits at bottom; fore lobe about half as long as hind lobe, convexly raised transversely; hind lobe sloping gently forward, with two fairly large pits in each anterolateral corner just behind transverse furrow; metanotum mostly concealed, with only its hind corners visible at either side. Abdominal tergites scarcely narrowed posteriorly, last tergite nearly twice as long as preceding segment; connexival segments dark brown on outer margins and intersegmental sutures; venter slightly flattened, with last ventrite nearly as long as two preceding segments combined, without spine or tubercle. Genital segments moderately large, plump, dark brown above, pale testaceous below; first genital segment broadly, roundly excavated behind; second segment clothed with very fine, moderately long, whitish hairs (visible from lateral aspect), without lateral spine or tubercle on each side.

Winged forms unknown.

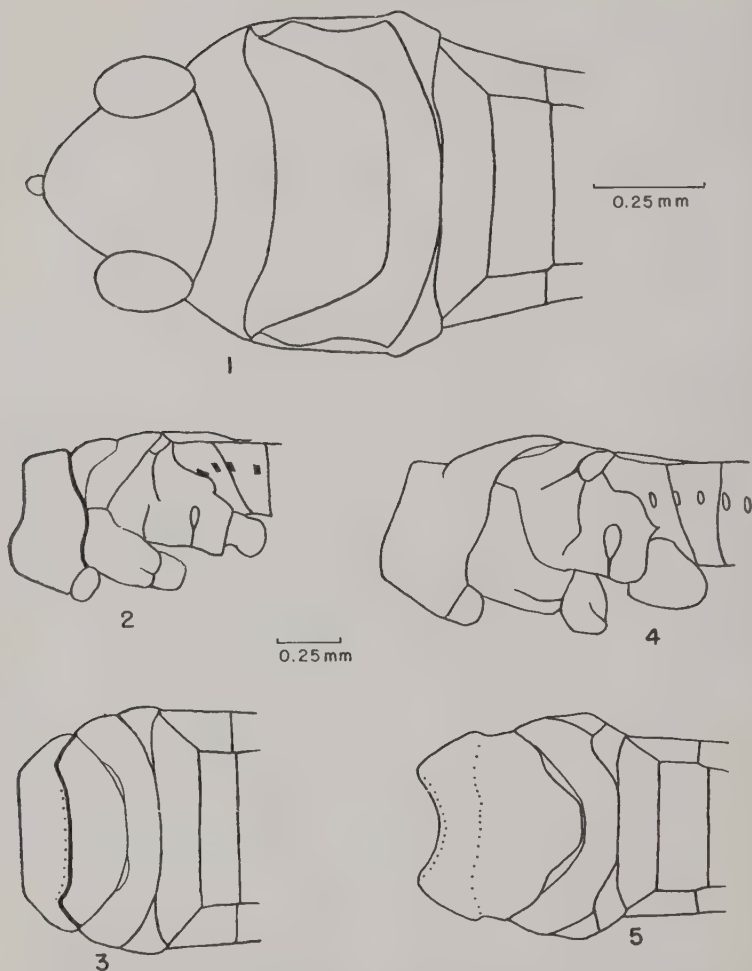
Length 1.90 mm., width 0.62 mm.

HOLOTYPE (APTEROUS MALE). Valparaiso, Chile, January 27, 1939 (C. J. Drake). An apterous female from Chile in the Reed collection is almost entirely testaceous; it lacks the last two antennal segments, but seems to be this species. This is the first species of *Microvelia* reported from Chile.

Separable from *M. mimula* F. B. White and allied forms by the unarmed second genital segment. In *M. mimula* the first genital segment is distinctly widened behind for reception of the long lateral spines on the second segment.

***Microvelia malkini*, n. sp.**

APTEROUS FORM. Moderately long; female subfusiform, male rather slender and with the abdomen more narrowed behind. Blackish, slightly velvety; a narrow transverse stripe near middle of pronotum, a large



EXPLANATION OF FIGURES

- Fig. 1. *Microvelia malkini*, n. sp. Head and thorax, dorsal view. (Outline of head conventionalized.)
 Fig. 2. *Microvelia americana* (Uhler). Thorax and base of abdomen, lateral view.
 Fig. 3. *Microvelia americana* (Uhler). Thorax and base of abdomen, dorsal view.
 Fig. 4. *Microvelia braziliensis* McKinstrey. Thorax and base of abdomen, lateral view.
 Fig. 5. *Microvelia braziliensis* McKinstrey. Thorax and base of abdomen, dorsal view.

triangular subbasal spot on anterior part of mesonotum, a median spot on each abdominal tergite, and a central spot in each connexival segment, brownish testaceous; dorsal surface with patches of silvery white pubescence; body testaceous beneath and on sides, with some blackish on median line. Head black or fuscous-black, with the usual impressed longitudinal median line; rostrum testaceous, its apex dark fuscous, slightly surpassing middle of mesosternum. Antennae long, slender, very shortly pubescent, dark fuscous, narrow base and under surface of first segment testaceous; relative lengths of segments I-IV, male 38:36:45:46, female 35:32:45:45 (80 units = 1 mm.)

Dorsal structure of apterous thorax (Fig. 1) basically similar to that of *M. americana* Uhler. Pronotum five times as wide as long (60:12), its front margin broadly but rather shallowly emarginate, hind margin directed slightly backward near lateral margins. Mesonotum divided into two lobes by an impressed suture; front lobe about twice as long as hind lobe, whose median length is subequal to that of pronotum; front lobe very nearly as wide anteriorly as pronotum, moderately narrowed posteriorly, its rear margin truncate. Metanotal triangles produced mediad as narrow, acute points; metapleura narrowly visible from above at either side of mesonotum. Last abdominal tergite nearly twice as long as preceding segment in both sexes; connexiva tapering posteriorly, very narrow behind; venter without spine or tubercle. Legs dark fuscous; coxae, trochanters, and basal part of femora testaceous; front femora largely testaceous, moderately stout, with long pale hairs beneath; hind legs long, slender, about equally long in both sexes, their femora unarmed. Measurements of legs (80 units = 1 mm.):

	Front	Middle	Hind
Femur	70	92	120
Tibia	48	85	150
Tarsal I	20	14	15
Tarsal II	—	28	30

Length, ♂ 2.40 mm., ♀ 2.75 mm.; width, ♂ 0.90 mm., ♀ 1.08 mm.

HOLOTYPE (MALE) AND ALLOTYPE (FEMALE). Tepic, Nayarit, Mexico, September 23, 1953 (B. Malkin); in California Academy of Sciences. PARATYPES: One female and one somewhat teneral male, taken with the types. Named in honor of the excellent collector and coleopterist, who found the species living and breeding in seepage on the side of a cliff, adjacent to a waterfall, where he was collecting beetles.

This species belong to the *americana* group of *Microvelia*, which generally are found close to the banks of streams, on running water. It is at once separable from other Mexican members of the group by the long slender, unarmed legs. The genital segments are retracted into the abdomen in the males at hand, and cannot be exposed without damaging the specimens. However, they are distinct from those of other species of the group.

A NOTE ON THE STRUCTURE OF THE APTEROUS THORAX

Parshley (1921) regarded the pronotum of apterous *M. americana* (and of *M. borealis*) as composite, formed of two "lobes"

with a transverse suture between them. The mesonotum, according to him, is a single, more or less crescent-shaped sclerite, occupying most of the dorsal surface between the pronotum and the abdomen, leaving the metanotum exposed only as small triangular areas at the postero-lateral corners of the thorax.

We conclude that only the "anterior lobe" of Parshley is referable to the prothorax, while his "posterior pronotal lobe" is in reality an anterior lobe of the mesonotum. Thus the mesonotum, rather than the pronotum, is composite in the *americana* group and the *pulchella* complex of *Microvelia*.

When the thoracic sutures of *M. americana* are examined from the side (Fig. 2), the most pronounced of them is the bisinuous one running nearly vertically from the rear margin of the front coxal cavity. This indicates that the prothorax is the relatively short segment of the body lying before this suture. Dissection of specimens treated with hot KOH and then decolorized shows that this suture is indeed the most profound of all, and on its dorsal portion its deeper parts are membranous, so that some slight degree of movement of prothorax on mesothorax may be possible. The front edge of the mesonotum is turned down inward to form a distinct apodeme for muscle attachments; and there is a single row of fairly large, subfoveate punctures along the hind edge of the pronotum, just within its margin.

By contrast, the suture between what we call the mesonotal lobes is slight and superficial, scarcely more than an impressed line bearing a row of much smaller punctures. It has no internal apodeme along its course, except the two so-called phragmal pits—which, however, lie just behind rather than in the suture. Indeed, this suture is virtually obsolete on the mid-dorsal portion in some specimens of *M. americana*.

Our viewpoint regarding the identity of these sclerites is supported by the thoracic structure in some other species of *Microvelia*, such as *M. braziliensis* McK. Here the pronotum is produced backward (Figs. 4, 5) so as nearly to cover the whole anterior mesonotal lobe, yet there can be no question as to what is pronotum and what is mesonotum. The postero-lateral margins of the pronotum are shallowly sinuate, and at these sinuities the suture between the mesonotal lobes is left exposed. In many specimens this suture is visible clear to the mid-dorsal line (Fig. 5), where it lies just behind the rear margin of the pronotum.

When the prothorax of the winged form of *M. americana* (or of *M. pulchella incerta*) is removed, the underlying mesonotum

is seen to be composite in much the same way that is found in the apterous form. The sclerite that we call the anterior mesonotal lobe is, however, roughly rectangular in the winged individuals, instead of sub-trapezoidal. Its posterior width is about the same as in apterous individuals, but its lateral margins are approximately parallel instead of strongly divergent anteriorly. The mesonotum of alate individuals is not at all, or only lightly, pigmented anteriorly, so that no discolorization is needed to reveal this structure.

In other wingless water-striders, such as Gerridae and *Mesovelina*, the prothorax is a short and very distinct segment of the body, while the mesothorax is much longer and is immovably fused with the metathorax. The thoracic structure of the *americana* group and the *pulchella* complex of *Microvelia* seems to stand close to this primitive type.

CHECK-LIST OF AMERICAN SPECIES OF MICROVELIA

1. *aemulana* Drake and Plaumann 1955—Brasil, Argentina.
2. *albonotata* Champion 1898; = *capitata*, Barber 1939, nec Guérin—U. S. east of Rocky Mts.; Utah; Mexico; Central America; West Indies; Venezuela, Peru.
3. *americana* (Uhler 1884)—U. S. east of Mississippi River; Minn., Iowa, Kansas, Nebr.; eastern Canada.
4. *ancona* Drake and Chapman 1954—Panama (in bromeliads).
5. *argusta* Drake and Capriles 1954—Puerto Rico.
6. *atrata* Torre-Bueno 1916—Ga., Fla., La.
7. *austrina* Torre-Bueno 1924; = *parallela* Blachley 1925—Md., Va., N. C., Tenn., Ind., Miss.; Mexico.
8. *ayacuchana* Drake and Capriles 1952—Venezuela (Amazonas), Brit. Guiana.
9. *beameri* McKinstry 1937—Texas, N. M., Ariz., Nev., Colo., Calif.; Mexico to Oaxaca; Jamaica.
10. *braziliensis* McKinstry 1937—Brasil, Ecuador, Peru, Bolivia, Paraguay.
11. *buenoi* Drake 1920—U. S. (rare in south); Canada; Alaska.
12. *californiensis* McKinstry 1937—Calif., Oregon; Baja California.
13. *capitata* Guérin 1857; = ?? *pulchella* subsp. *incerta* (Kirby)—Cuba.
14. *cerifera* McKinstry 1937—Iowa, Kansas, Nebr., Colo., Utah, Calif.
15. *chilena* Drake and Hussey 1955—Chile.
16. *cinchonana* Drake and Hussey 1954—Jamaica.
17. *circumcincta* Champion 1898—Guatemala; Mexico.
18. *costaiana* Drake and Hussey 1951—Brasil.
19. *cubana* Drake 1951—Cuba; Dominican Republic.
20. *distanti* Lundblad 1933; = *insignis* Distant 1912, preocc.—Trinidad; Dominica (in bromeliads).
21. *duidana* Drake and Capriles 1952—Venezuela (Amazonas), Brit. Guiana.
22. *fasciculifera* McKinstry 1937—Texas, Ariz.; Mexico.
23. *flavipes* Champion 1898—Mexico.

24. *fontinalis* Torre-Bueno 1916—N. Y., N. J., Pa., Md., Va., Ohio, Mich., Ind., Ill., Tenn., Miss., Minn., Iowa.
25. *gerhardi* Hussey 1924—Nebr., Utah, Wyo., Colo., N. M., Ariz., Calif.; north and central Mexico.
26. *guatemalensis* McKinsty 1937—Guatemala.
27. *hambletoni* Drake 1951—Peru.
28. *hinei* Drake 1920—Canada to Argentina.
29. *hungerfordi* McKinsty 1937—Argentina, Paraguay.
30. *inannana* Drake and Hottes 1952—Argentina, Brasil.
31. *intonsa* Drake 1951; =*crinita* [as *crinata*, typ. error] Drake 1951, preocc.—Panama.
32. *ioana* Drake and Hottes 1952—Rio de Janeiro.
33. *irrasa* Drake and Harris 1928—Mexico.
34. *lacunana* Drake and Plaumann 1953—Mato Grosso.
35. *laesslei* Drake and Hussey 1954—Jamaica (in bromeliads).
36. *limaiana* Drake 1951—Brasil; Panama.
37. *longipes* [male] Uhler 1894; =*modesta* [female] Uhler 1894—West Indies; Venezuela, Brit. Guiana, Peru, Ecuador, Brasil, Paraguay, Argentina.
38. *lujanana* Drake 1951—Argentina.
39. *malkini* Drake and Hussey 1955—Mexico (Nayarit).
40. *marginata* Uhler 1893; =*pudoris* Drake and Harris 1936—West Indies; Mexico, Panama; Venezuela, Peru; Florida Keys.
41. *mimula* F. B. White 1879; =*capitata*, Uhler 1894, nec Guérin; =*mendozaana*⁴ Jensen-Haarup 1920; =*myersi* McKinsty 1937—West Indies; Panama; Brasil, Ecuador, Paraguay, Argentina.
42. *minima* Drake 1952—Brasil.
43. *munda* Drake 1951—Panama.
44. *novana* Drake and Plaumann 1955—Brasil.
45. *oaxacana* Drake 1951—Mexico (Oaxaca, in bromeliads).
46. *oraria* Drake 1952—Costa Rica.
47. *paludicola* Champion 1898; =*alachuana* Hussey and Herring 1950—Mexico, Central America; West Indies; Fla., Miss., Colo., Ariz., Calif.
48. *panamensis* Champion 1898—Panama.
49. *parana* Drake and Carvalho 1954—Brasil.
50. *peruviensis* McKinsty 1937—Peru.
51. *pexa* Drake and Hussey 1951—Mexico.
52. *portoricencis* Drake 1951—Puerto Rico; Florida Keys.
53. *pueblana* Drake and Hottes 1952—Mexico.
54. *pulchella* Westwood 1834—Neotropical region (except Chile?); Fla., Miss., Texas, Ariz.
- 54a. *pulchella* subsp. *incerta* (W. F. Kirby 1890); =??*capitata* Guérin 1857; =*boreale* Torre-Bueno MS. in various lists; =*borealis* Torre-Bueno 1916, NEW SYNONYMY; =*marginata*, Uhler 1894 in part; =*robusta* Uhler 1894—U. S.; Canada; neotropical region (except Chile?).
55. *quieta* Drake and Carvalho 1954—Brasil.
56. *rasilis* Drake 1951—Mexico.

⁴ This NEW SYNONYMY was discovered in August 1955 when the type of *M. mendozaana* was studied at Copenhagen.

57. *recifana* Drake 1951—Brasil.
 58. *rufescens* Champion 1898; —*hidalgoi* McKinstry 1937, NEW SYNONYMY
—Guatemala, Costa Rica.
 59. *sarpta* Drake and Harris 1936—Brasil.
 60. *schmidtii* McKinstry 1937—Costa Rica.
 61. *signata* Uhler 1894; =*setipes* Champion 1898; =*oreades* Drake and
Harris 1928—Colo., Utah, N. M., Ariz., Calif.; northwestern Mexico.
 62. *stellata* Kirkaldy 1902—Ecuador, Peru, Brasil, Bolivia, Paraguay; Trini-
dad.
 63. *summersi* Drake and Harris 1928—Grenada, Trinidad; Panama; Brasil,
Brit. Guiana.
 64. *tateiana* Drake 1951—Puerto Rico.
 65. *torquata* Champion 1898—Guatemala; Mexico.
 66. *trinitatis* China 1943—Trinidad.
 67. *vagans* F. B. White 1878; =*pacifica*, W. E. Hoffmann 1925, nec Kir-
kaldy; =*williamsi* [nomen nudum] McKinstry 1937—Hawaii.
 68. *venustatis* Drake and Harris 1933—Brasil, Peru, Paraguay.
 69. *verana* Drake and Hottes 1952—Mexico.
 70. *zillana* Drake and Hottes 1952—Puerto Rico.
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TENTH INTERNATIONAL CONGRESS OF ENTOMOLOGY

Montreal, Canada, 1956

The Tenth International Congress of Entomology will be held in Montreal on August 17-25, 1956. Following the Congress a number of excursions to places of entomological interest will be arranged.

All those hoping to attend the Congress and wishing to obtain further information should communicate as soon as possible with the Secretary, Mr. J. A. Downes, Division of Entomology, Science Service Building, Ottawa, Ontario, Canada.

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LADY BEETLES (COCCINELLIDAE: COLEOPTERA)
FOUND ON CITRUS IN FLORIDA ¹

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The following annotated list of lady beetles represents the known coccinellid fauna of citrus groves in Florida at the present time. This list has been compiled during the course of an intensive survey of the predators and parasites of citrus insects and mites. Although it is recognized that the list is probably incomplete for vagrants, it is believed that most species commonly feeding on citrus insects and mites have been recognized. The present list should be considered supplementary to that published by G. B. Merrill in 1922 which listed and discussed all of the lady beetles known to occur in Florida.

For each species listed, the original description is cited, intra-state and seasonal distribution is discussed and food habits on citrus noted. For the common species only a few selected records have been included; all records have been cited for species uncommon or rare on citrus. For ease of reference the species are listed alphabetically.

Acknowledgments are due the survey personnel of the University of Florida Citrus Experiment Station at Lake Alfred for valuable assistance in obtaining geographic and seasonal distribution records. The survey staff headed by Dr. R. M. Pratt includes H. Holtsberg, K. Townsend, W. Davis, J. B. Weeks and T. B. Hallam. Thanks are also due Dr. E. A. Chapin, West Medway, Mass., who read the manuscript for systematic errors and provided several citations.

Chilocorus stigma (Say)

Coccinella stigma Say, 1835, Jour. Nat. Hist. Soc. Boston, Vol. 1, p. 202.

This species, commonly known as the twice-stabbed lady beetle, is the most abundant species found on citrus in the state. It is distributed throughout the citrus-growing areas and normally reaches a population peak in late winter, spring and early summer. Although it has been recorded feeding on many species of scale insects, mealybugs, aphids and whiteflies, its preferred

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food on citrus is Florida red scale, *Chrysomphalus aonidum* (L.). Seasonally abnormal beetle-population peaks are occasionally found on heavy infestations of this scale.

RECORDS: Goldenrod, 8 spms., Nov. 20, 1951 (W. Davis). Vero Beach, 5 spms., Nov. 13, 1951 (H. Holtsberg). Indian Rocks, 9 spms., Nov. 8, 1951 (K. Townsend). Lake Placid, 2 spms., Dec. 3, 1951 (J. B. Weeks). Ft. Pierce, 4 spms., July 18, 1953 (M. H. Muma and W. Long).

Cycloneda sanguinea (L.)

Coccinella sanguinea Linne, 1763, Systema Naturae, Ed. 12, p. 11.

This species, known by the common name blood-red lady beetle, is quite common on citrus in the spring and early summer. It is widely distributed in the citrus-growing areas. Although the species feeds predominantly on aphids it has been recorded eating citrus red mites, *Metatetranychus citri* (McG.); six-spotted mites, *Eotetranychus sexmaculatus* (Riley); mealybugs and scale insects.

RECORDS: Vero Beach, 4 spms., Nov. 13, 1951 (H. Holtsberg). Avon Park, 6 spms., March 6, 1952 (J. B. Weeks). Goldenrod, 2 spms., Nov. 14, 1952 (W. Davis). Bamboo, 3 spms., Jan. 9, 1952 (M. H. and K. E. Muma). Lutz, 6 spms., Mar. 18, 1952 (K. Townsend).

Celeomegilla maculata var. *floridana* (Leng)

Megilla maculata var. *floridana* Leng, 1903, Jour. N. Y. Ent. Soc., Vol. XI, p. 38.

Only two specimens of this vagrant species have been taken on citrus in Florida. Nothing is known concerning the seasonal and state distribution.

RECORDS: Unknown locality, one specimen, Oct. 25, 1950 (J. T. Griffiths). Vero Beach, one specimen, Apr. 14, 1953 (H. Holtsberg).

Cryptolaemus montrouzeri Muls.

Cryptolaemus montrouzeri Mulsant, 1853, Ann. Soc. Linn. Lyon, Vol. 1, p. 140.

The introduced Australian mealybug lady beetle apparently is widely distributed in the citrus areas of the state, but is not common on citrus. Populations occasionally are found on mealybug infestations in the spring. The species has also been collected while feeding on soft brown scale, *Coccus hesperidum* (L.).

RECORDS: Auburndale, many spms., May 13, 1953 (R. Johnson and M. H. Muma). Bradenton, 2 spms., May 25, 1954 (M. H. Muma).

Delphastus catalinae (Horn)

Cryptognatha catalinae Horn, 1895, Trans. Amer. Ent. Soc., Vol. 22, p. 83.

This species is included in this list doubtfully. It was introduced on citrus in the Clearwater area in 1917 in an effort to obtain biological control of the citrus whitefly, *Dialeurodes citri* (Ashm.). No recent specimens of the species have been collected.

RECORDS: Cortez, 2 specimens, Nov. 14-16, 1918 (H. B. Swartsel).

Delphastus pallidus (Lec.)

Oeneis pallidus LeConte, 1878, Proc. Amer. Philosophical Soc., Vol. XVII, p. 400.

This tiny lady beetle is uncommon to rare on citrus in Florida. The principal food is whiteflies with all records to date being from the cloudy-winged whitefly, *Dialeurodes citrifolii* (Morg.). At present the species is known from the East Coast, West Coast and Ridge districts of the citrus growing region.

RECORDS: Vero Beach, one specimen, May 25, 1951 (H. Holtsberg). Mims, two specimens, July 19, 1951 (H. Holtsberg). Scottsmoor, one specimen, June 19, 1953 (H. Holtsberg). Indian Rocks, one specimen, Nov. 8, 1951 (K. Townsend). Lake Alfred, three specimens, Sept. 9, 1953 (M. H. Muma).

Delphastus pusillus (Lec.)

Oeneis pusillus LeConte, 1852, Proc. Acad. Nat. Sci. Phila., Vol. VI, p. 135.

This small black lady beetle is the second most-common whitefly-eating species in the state. It is widely distributed in the citrus growing areas and reaches its peak population in the fall and early winter. To date it has been recorded feeding on citrus whitefly, *Dialeurodes citri* (Ashm.), and cloudy-winged whitefly, *Dialeurodes citrifolii* (Morg.). It probably also feeds on the wooly whitefly, *Aleurothrixus howardi* (Quaint.).

RECORDS: Plant City, 19 spms., Nov. 21, 1951 (K. Townsend). Winter Haven, 30 spms., June 16, 1952 (M. H. Muma). Brooksville, 8 spms., Oct. 16, 1951 (K. Townsend). Crescent City, 3 spms., Mar. 11, 1953 (H. Holtsberg). Vero Beach, 6 spms., June 16, 1952 (H. Holtsberg).

Decadiomus bahamicus (Csy.)

Scymnus bahamicus Casey, 1899, Jour. N. Y. Ent. Soc., Vol. VII, p. 159.

This tiny, distinctive species has been taken at only one locality feeding on citrus mealybugs, *Pseudococcus citri* Risso.

RECORDS: Auburndale, three specimens, May 13, 1953 (R. Johnson and M. H. Muma), and one specimen, May 25, 1953 (M. H. Muma).

***Exochomus marginipennis childreni* Muls.**

Exochomus childreni Mulsant, 1850, Ann. Soc. d'Agric. Lyon, Vol. 2, p. 1037.

Although this is the most common subspecies of the genus on citrus, seldom are more than a few specimens seen at one time. Records indicate that the subspecies is somewhat limited in distribution to the central citrus-growing region. Although the species has been recorded feeding on aphids, it is commonly taken in scale infestations. Insufficient material has been collected to determine seasonal distribution.

RECORDS: Dundee, one specimen, Nov. 28, 1951 (E. D. Harris). Apopka, 18 spms., May 6, 1952 (M. H. Muma). Tavares, one specimen, March 5, 1953 (W. Davis). Lake Alfred, one specimen, May 7, 1952 (R. Johnson). Minneola, 7 spms., April 19, 1953 (M. H. Muma).

***Exochomus marginipennis marginipennis* Lec.**

Exochomus marginipennis LeConte, 1824, Ann. Lyc. Nat. Hist. N. Y., Vol. I, p. 174.

This, the typical subspecies of the species, apparently is rare on citrus in the state and restricted to the south central region. No data are available on seasonal distribution.

RECORDS: Lake Placid, 2 spms., Oct. 1950 (J. B. Weeks). Lake Wales, 2 spms., August 21, 1952 and one specimen, Jan. 23, 1953 (T. B. Hallam).

***Hippodamia convergens* Guer.**

Coccinella (Hippodamia) convergens Guerin, Icon. Regne Animal, Insectes, Paris, 1829-1838, p. 321.

Although the convergent lady beetle is reported to have been common on citrus at one time, it has been comparatively rare in recent years. Only two recent records are available. It is primarily an aphid feeder.

RECORDS: Lake Magdalene, one specimen, Jan. 31, 1951 (K. Townsend). Winter Garden, one specimen, June 18, 1952 (W. Davis).

***Leis dimidiata quinque-decimmaculata* (Hope)**

Coccinella 15-maculata Hope in Gray. Zool. Miscell., 1831, p. 30.

The Chinese lady beetle introduced on citrus and at one time reportedly common in certain areas is now mainly restricted to a single locality. It is primarily an aphid feeder and reaches peak population in the spring and early summer.

RECORDS: Winter Garden, 3 spms., Apr. 16, 1952 (W. Davis). Ocoee, one specimen, June 4, 1952 (W. Davis). Winter Park, 9 spms., Mar. 19, 1953 (W. Davis). Auburndale, 2 spms., April 21, 1954 (T. B. Hallam).

***Microwiseia coccidivora* (Ashm.)**

Hperaspidium coccidivora Ashmead, 1880, Orange Insects, p. 10.

This, the little scale-eating lady beetle, apparently is the second most-common scale-feeding species on citrus in the state. Due to its small size it is easily overlooked and may actually be more common than *Chilocorus stigma* (Say). Although the species has been recorded from the East Coast, it is much more abundant in the north central citrus-growing region. The population peak occurs in late spring and early summer. The species feed on both purple, *Lepidosaphes beckii* (Newm.), and Florida red scale, *Chrysomphalus aonidum* (L.), but apparently prefers the latter.

RECORDS: Apopka, 2 spms., Apr. 22, 1952 (M. H. Muma). Lake Magdalene, 3 spms., Aug. 21, 1952 (K. Townsend). Lake Alfred, one specimen, May 21, 1952 (D. Ozanne). Winter Park, one specimen, June 26, 1952 (W. Davis).

***Nephaspis gorhami* Csy.**

Nephaspis gorhami Casey, 1899, Jour. N. Y. Ent. Soc., Vol. VII, p. 168.

This little black and white lady beetle has been recorded feeding on cloudy-winged whitefly, *Dialeurodes citrifolii* (Morg.), citrus whitefly, *Dialeurodes citri* (Ashm.), and wooly whitefly, *Aleurothrixus howardi* (Quaint.). It is the most common species attacking whiteflies on citrus in Florida. The species is distributed throughout the citrus-growing areas of the state and attains a population peak in the winter and early spring.

RECORDS: Weirsdale, 2 spms., Dec. 19, 1951 (M. H. Muma). Indian Rocks, 7 spms., Nov. 8, 1951 (K. Townsend). Ft. Pierce, 2 spms., Sept. 10, 1952 (H. Holtsberg). DeLand, 10 spms., Nov. 9, 1951 (H. Holtsberg). Dundee, 12 spms., June 15, 1952 (M. H. Muma).

***Olla abdominalis* (Say)**

Coccinella abdominalis Say, 1825, Jour. Acad. Nat. Sci. Phila., Vol. IV, p. 95.

The ash-grey lady beetle has been recorded at least once on citrus in the northern part of the state; the food was not noted.

RECORD: Bowling Green, one specimen, Sept. 9, 1949 (L. B. Hill).

***Olla abdominalis* var. *plagiata* Csy.**

Olla plagiata Casey, 1899, Jour. N. Y. Ent. Soc., Vol. VII, p. 94.

The southern two-spotted lady beetle is distributed throughout the citrus-growing areas of the state. Peak populations occur

in the late winter, spring, and early summer. The species apparently is an omnivorous feeder; it has been recorded feeding on mealybugs, aphids and citrus red mites, *Metatetranychus citri* (McG.). During some years the species is quite common but recently populations have been low except in isolated groves.

RECORDS: Palm Harbor, one specimen, June 2, 1952 (K. Townsend). Auburndale, 9 spms., May 13, 1953 (M. H. Muma and R. Johnson). Oklawaha, 8 spms., April 21, 1952 (W. Davis). Lake Placid, one specimen, March 3, 1952 (J. B. Weeks). Vero Beach, 2 spms., May 12, 1952 (H. Holtsberg).

Psyllobora parvinotata Csy.

Psyllobora parvinotata Casey, 1899, Jour. N. Y. Ent. Soc., Vol. VII, p. 101.

This little, white, black-spotted lady beetle apparently is a vagrant on citrus. It has been collected only four times. The species is believed to be a fungus feeder.

RECORDS: Wauchula, one specimen, March 16, 1951 (W. Davis). Vero Beach, one specimen, June 27, 1951 and 3 spms., June 16, 1952 (H. Holtsberg). Merritt Island, one specimen, Mar. 30, 1953 (H. Holtsberg).

Rodolia cardinalis (Muls.)

Vedalia cardinalis Mulsant, 1851, Ann. Soc. d'Agric. Lyon, Vol. II, p. 906.

Since its introduction, the vedalia has become distributed throughout the citrus-growing areas of the state. Peak populations occur concurrently with those of the host insect, cottony-cushion scale, *Icerya purchasi* Mask.

RECORDS: Records of this well known species would be superfluous.

Scymnillodes subtropicus Csy.

Delphastus subtropicus Casey, 1924, Mem. Coleop., Vol. XI, p. 170.

To date this little steel-blue lady beetle has been taken on citrus only at Vero Beach in the East Coast citrus region. Nothing is known of the food habits. It is probably a vagrant.

RECORDS: Vero Beach, one spm., May 20, 1953, 2 spms., June 16, 1953 and one spm., Dec. 16, 1952 (H. Holtsberg).

Scymnillus aterrimus Horn

Scymnillus aterrimus Horn, 1895, Trans. Amer. Ent. Soc., Vol. XXII, p. 110.

This little black lady beetle has been collected only twice from citrus.

RECORDS: Apopka, one spm., April 22, 1952 (M. H. Muma). Auburn dale, one spm., Sept. 18, 1952 (T. B. Hallam).

Scymnus melsheimeri WS.

Scymnus collaris Melsheimer, 1847, Proc. Acad. Nat. Sci. Phila., Vol. III, p. 180. *Scymnus melsheimeri* Weise, 1927, Zool. Jahrb. Suppl. XVI, Heft I, p. 33 (new name— not *collaris* Herbst).

This species, commonly known as the collared lady beetle, is most frequently collected from aphid colonies. Next to the blood-red lady beetle, it is the most common aphid-feeding species on citrus at the present time. It is most abundant in the spring and early summer.

RECORDS: Weirsdale, 2 spms., Oct. 13, 1952 (M. H. Muma). Umatilla, one spm., April 18, 1952 (W. Davis). Scottsmeer, one spm., June 17, 1952 (H. Holtsberg). Waverly, one spm., May 18, 1953 (T. B. Hallam).

Scymnus partitus Casey

Scymnus partitus Casey, 1899, Jour. N. Y. Ent. Soc., Vol. VII, p. 158.

This tiny species has been taken only twice on citrus. It is believed to be an aphid feeder.

RECORDS: Lakeland Heights, one spm., May 27, 1952 (T. B. Hallam). Spring Lake, one spm., Nov. 14, 1951 (K. Townsend).

Scymnus flavifrons Melsh.

Scymnus flavifrons Melsheimer, 1847, Proc. Acad. Nat. Sci. Phila., Vol. III, p. 181.

This is the most common species of the genus found on citrus in Florida. Although several specimens have been observed feeding on scale insects, the primary food is mealybugs. Largest populations of the species are found in the spring in groves heavily infested with mealybugs. The species appears to be well distributed through the citrus-growing region.

RECORDS: Apopka, one specimen, Apr. 29, 1952 (K. E. Muma). Clearwater, one specimen, June 2, 1952 (K. Townsend). Lakeland Heights, 5 spms., May 27, 1952 (T. B. Hallam). Auburndale, 18 spms., June 6, 1952 (M. H. Muma). Merritt Island, one specimen, June 29, 1953 (H. Holtsberg).

Stethorus utilis Horn

Stethorus utilis Horn, 1895, Trans. Amer. Ent. Soc., Vol. XXII, p. 107.

This little mite-eating lady beetle feeds primarily on the six-spotted mite, *Eotetranychus sexmaculatus* (Riley), but has been

recorded feeding on the citrus red mite, *Metatetranychus citri* (McG.), and *Hemitarsonemus peregrinus* Beer. Peak populations of the species occur concurrently with those of the favored host in the late spring. The species has been collected in every citrus-growing area of the state.

RECORDS: Umatilla, one specimen, April 18, 1952 (W. Davis). Lake Alfred, 11 spms., May 1, 1952 (M. H. Muma). Crescent City, one specimen, Mar. 11, 1953 (H. Holtsberg). Vero Beach, one specimen, May 18, 1953 (H. Holtsberg).

LITERATURE CITED

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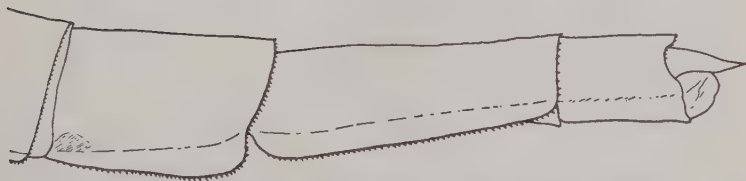
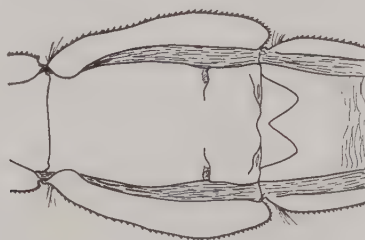
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GOMPHUS AUSTRALIS NEEDHAM IN NORTH FLORIDA,
WITH A DESCRIPTION OF THE FEMALE
(ODONATA: GOMPHIDAE)

WILLIAM H. CROSS
University of Georgia

Arigomphus australis was described as a new species of Odonata from Florida by Dr. J. G. Needham (1897). The species has since been transferred to the subgenus *Gomphus*, while *Arigomphus* has been given subgeneric standing in the large and varied genus *Gomphus* (Needham, 1948). In 1950 Dr. M. J. Westfall, Jr., adequately discussed the past history and present relationships of *australis*, recording a number of recent collections of the species.



Gomphus australis Needham. Upper figure, ventral view of female abdominal segment 8, showing the subgenital plate projecting over 9, lower figure, lateral view of female abdominal segments 8, 9, 10, and appendages (dense pubescence not shown).

While I was collecting dragonflies at Lake Bradford in Leon County, Florida on March 31, 1951, I took two female *Gomphus*. Because they had an exceptionally long abdominal segment 9 and cross-striped face, I suspected that they might be *australis*, the female of which was undescribed. When on April 14 exuviae of two female *australis* were found on the bases of cypress trunks hardly 200 yards from the collecting site of the adults,

the identification seemed even more certain. Dr. Westfall has looked at both adults and agrees with me that they are *australis*. I am therefore submitting the following description:

***Gomphus australis* Needham**

FEMALE: Both females are very similar to Needham's description of the male.

Head. Face densely covered with blackish hairs, olive-yellow except for narrow, dark brown fronto-clypeal stripe. Stripe across base of labrum hardly evident. Rear of frons dark brown below, whole of vertex black. Occiput yellow, convex, ciliate with long black hairs. Rear of eyes black above, yellow below. Labium and maxillary bases light yellow.

Thorax. Color pattern as described by Needham for the male except dark brown on prothorax rather than black. All femora pale internally, dark brown externally. Tarsi and tibiae, except partially pale knees, black. Femoral and tibial spines black. All of thorax and outer faces of femora densely covered with long hairs, mostly dark but becoming pale on venter of thorax and on hind femora. Wings hyaline with very slight suffusion of amber yellow at base, costa with yellow edge, stigma yellow-brown.

Abdomen. General color black grading into brown on first two and last two segments. With yellow areas as follows: dorsal square on 1; dorsal lanceolate spots on 2-8, a little widened anteriorly and continuing faintly to or almost to posterior margin along dorsal carinae; an almost continuous lateral stripe, broad on 1 and 2, more dull and less distinct on 3-7; expanded portions of 7-9, 10 and terminal appendages pale brown. 7-10 conspicuously pilose with short brown hairs. The comparative lengths of 7, 8, 9, and 10 are approximately as 9:7:10:4, respectively. See illustrations of the terminal segments and the subgenital plate.

Measurements (in millimeters). Total length, 54; abdomen, 39; hind femur, 9; hind wing, 29.

DISPOSITION OF SPECIMENS. One female is designated as allotype and deposited in the Cornell University collection along with the male holotype. The other female is retained in the writer's collection. No variation is apparent between the two individuals.

No illustrations appear with the original description. Needham and Heywood (1929) included drawings of the male accessory genitalia and terminal appendages. Westfall (1950) gave excellent photographs of the exuviae, as well as the genitalia and terminal segment of the male abdomen.

Since former records for *australis* are from central and southern Florida (Seminole, Orange, and Highlands Counties), this Leon County record is a considerable northward extension of its range. In a recent letter Dr. Westfall has informed me that he collected a large nymph of *australis* at Gold Head Branch State Park in Clay County, Florida, on February 26, 1955. He

has kindly given me permission to include this latest record of the species.

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